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Fastening of a Riding Ring to the Casing of a Rotary Cylinder

DESCRIPTION

The invention relates to a fastening of a riding ring on the casing of a rotary cylinder, in particular a rotary furnace for the heat treatment of free-flowing materials, in particular bulk solids such as raw cement mix, whereby the riding ring, which encircles the rotary casing with clearance, is locked in the axial direction and in the circumferential direction relative to the rotary cylinder via support elements affixed to the casing of the rotary cylinder.

There are mainly two different fastening types used to fasten riding rings to the casing of a rotary cylinder e.g. of a rotary furnace:

1. The so-called loose riding ring fastening (floating tire), known e.g. from DE-A-32 03 241. The riding ring is thereby not rigidly connected with the casing of the rotary cylinder but rather encircles the casing with radial play. On the riding ring station, the radial loads or forces from the furnace cylinder must be fed to the track rollers via the riding ring and to the baseplate via the bearing blocks. The riding ring is smooth on all sides and its axial movement is restricted by the retaining element fastened to the casing of the rotary cylinder. In the circumferential direction, the riding ring can move freely relative to the casing of the furnace and namely on washer plates, which are loosely inserted into the ring gap between the riding ring and the casing of the furnace, whereby any necessary corrections to the play of the riding ring can be made by switching out the washer plates. Ovalizations and other deformations of the casing of the rotary cylinder can be compensated for to a certain extent with this type of riding ring. However, the play of the riding ring and the relative movement of the riding ring must be constantly monitored using a measuring device for the safe and secure operation of this type of riding ring station.

2. The so-called fixed riding ring fastening (fixed tire), known e.g. from DE-A-38 01 231 as well as EP-B-0 765 459. The interior surface of the riding ring fastening known from the first document is provided with cogs like an inner toothed rim, and the riding ring is supported in the axial direction as well as in the circumferential direction on retaining elements welded to the casing of the rotary cylinder via these cogs as well as wedges and washer plates. The riding ring fastening known from the second document has through holes distributed around the perimeter, through which through bolts can be fed, the ends of which are affixed to retaining elements of the casing of the rotary cylinder so that, in this manner, the riding ring is fixed not only in the axial

direction but also in the circumferential direction. It is understood that both the planing and shaping of the internal teeth of a riding ring as well as the boring of holes in the riding ring are very costly production steps. Add to this the fact that material sectional weakenings are caused by both the inner teeth as well as by the through holes of the known riding rings, which is why these known riding rings must be constructed to be relatively thick-walled, which in turn leads to higher costs.

The object of the invention is to create a fastening for a riding ring of a rotary cylinder, in particular a rotary furnace, whereby the riding ring, irrespective of its locking, can be immobilized in the axial direction as well as in its circumferential direction with respect to the casing of the rotary cylinder without the riding ring requiring complex machining like planing, shaping, and the creation of through holes, etc.

This object is solved in accordance with the invention with a riding ring fastening with the characteristics of claim 1. Advantageous embodiments of the invention are specified in the sub-claims.

In the riding ring fastening according to the invention, the riding ring itself is manufactured as a pure turning work piece, i.e. the cast or forged riding ring only needs to be processed on a carousel lathe machine, which needs to be used anyway to finish the riding ring to the desired external diameter and inner diameter. Further machining like planing, shaping, boring, etc. is not required. With one and the same lathe machine, only circular grooves, in which clamping elements distributed around the perimeter are force fit, which on the other hand are connected with support elements affixed to the casing of the rotary cylinder and which lock the riding ring in both the axial direction and the circumferential direction, are turned into the riding ring, whereby, however, radial play is retained between the casing of the rotary cylinder and the interior surface of the riding ring and the inner surface of the riding ring for the incorporation of thermal expansions, deformations of the rotary cylinder, etc.

In accordance with another characteristic of the invention, the circular grooves of the riding ring are arranged on the interior surface of the riding ring and/or on at least one of the lateral surfaces of the riding ring as annular tensioning grooves, and the clamping elements can be designed as screw jaws, which engage with the tensioning groove on one hand and are fastened between the support elements of the casing of the rotary cylinder on the other hand and which each have a clamping screw. After the clamping screw is pulled, the screw jaw or the clamping element is force fit on the riding ring. The clamping elements or the clamping jaws are freely accessible, so that a retensioning or switching out of the clamping jaws can take place at any time. The

clamping elements or the clamping jaws can be standard parts, which also fit for rotary-cylinder riding rings of different diameters. As a rule, the riding ring supports the casing of the rotary cylinder centrically via its clamping jaws, which are distributed around the perimeter and are force fit, whereby the riding ring no longer experiences relative movement with respect to the casing of the rotary cylinder. If necessary, e.g. in the case of non-round and/or arched rotary-cylinder casings, it is also possible to support the bearing ring eccentrically on the casing of the rotary cylinder via its clamping elements. In either case, play remains for the riding ring, which is fixed in the axial and circumferential directions, in the radial direction with respect to the rotary-cylinder casing. This play enables an unhindered expansion of the rotary-cylinder casing, e.g. during heating.

In accordance with another characteristic of the invention, the screw jaws of the clamping elements can be designed angularly, with an axial angular arm, the hook-shaped end of which engages with the circular groove arranged on the interior surface of the riding ring, while the radial angular arm supports the at least one clamping screw mentioned above, which engages with the circular groove arranged on the neighboring lateral surface of the riding ring and thus tensions the clamping element with the riding ring in a force-fitting manner.

But, the screw jaws of the clamping elements can also be designed like grippers or shears, whereby the jaws of the grippers or the ends of the shears can be clamped in the circular grooves of the lateral surfaces of the riding rings.

The invention and its further characteristics and advantages are described in greater detail using the exemplary embodiments illustrated schematically in the figures.

The figures show the following:

Fig. 1: A cross section of a rotary-cylinder casing with clamping elements distributed over the perimeter, which clamp a riding ring that is shown from the side on the rotary-cylinder casing,

Fig. 2: A partial longitudinal section through the rotary-cylinder casing with a tensioned riding ring force-fit on it via clamping elements or screw jaws,

Fig. 3: A partial top view of the riding ring fastening,

Fig. 4: As variants for Figure 3, a riding ring fastening, in which the screw jaws of the clamping elements are designed like grippers on the right side of the riding ring and like shears on the left side of the riding ring,

Fig. 5: A partial top view of the riding ring fastening or the support elements fastened on the rotary-cylinder casing, designed as spring guides,

Fig. 6: As variants for Figures 2 and 4, another type of riding ring fastening, and

Fig. 7: The lateral view of a riding ring with a circular groove, into which clamping elements distributed over the perimeter with tapered force transfer surfaces are inserted.

Figure 1 shows a lateral view of riding ring 10, which is fastened on the casing 11 of a rotary cylinder, e.g. of a rotary furnace. The riding ring 10 encircles the rotary-cylinder casing 11 with radial play 12, and it is clamped in the axial direction and in the circumferential direction relative to the rotary cylinder via support elements 13, 14, which are fastened on the rotary-cylinder casing 11 by means of the clamping elements 15, 16, etc. described below. On the bottom side, the riding ring 10 is mounted on two track roller stations 17 and 18. Despite the immobilization of the riding ring 10, the radial play 12 allows an unhindered expansion of the rotary-cylinder casing 11 through heating, deformations, etc.

The entire riding ring 10 is manufactured inexpensively as a turning work piece on a carousel lathe machine, i.e. the riding ring has no bore holes, cogs, etc. As can be seen in Figure 1, clamping elements 15, 16, etc. are arranged around the perimeter of the riding ring 10; on one hand, they engage in a force-fit manner with the circular grooves (as can be seen in Figures 2 and 4 through 7) of the riding ring and on the other hand are connected with the support elements 13, 14, etc. fastened to the rotary-cylinder casing 11 and they immobilize the riding ring in both the axial and circumferential directions.

As can be seen in Figure 2, annular tensioning grooves 19, 20, with which screw jaws 21 of the clamping elements 15, 16 engage, are turned into the interior surface of the riding ring 10 and/or into at least one lateral surface of the riding ring, whereby each of these screw jaws are arranged between the support elements 13, 14 fastened on the rotary-cylinder casing 11, as can also be seen in Figures 1 and 3. The screw jaws 21 of the clamping elements distributed around the perimeter of the riding ring 10 are designed angularly, and the axial angular arm with a hook-shaped end 22 or ends 22a and 22b in accordance with the exemplary embodiment in Figure 3 engages almost swallow-tail-like with the circular groove 19 arranged on the interior surface of

the riding ring, while the radial angular arm supports at least one tensioning screw 23, which engages with the circular groove 20 arranged on the neighboring lateral side of the riding ring and which, after being pulled, tensions in a force-fit manner the screw jaws 21 of the clamping element with the riding ring 10. The clamping screw 23 can still be secured by a screw 24 screwed into the radial angular arm of the screw jaws.

As can be seen in the top view in Figure 3, the tensioning between the clamping element designed like screw jaws 21 and the riding ring 10 can be advantageously designed as a symmetrical 3-point transfer of force with two spaced hooks 22a, 22b per angular screw jaw 21 arranged on the axial angular arm, which lie symmetrically opposite the clamping screw 23 arranged in the radial angular arm of the screw jaws.

In accordance with the exemplary embodiment in the right half of Figure 4, the screw jaws of the clamping elements can be designed like grippers, the gripper jaws 25a, 25b of which engage with or clamp into two concentric circular grooves 20a, 20b in the lateral surfaces of the riding ring 10, if necessary with the help of undercuts. In accordance with the exemplary embodiment in the left half of Figure 4, the screw jaws of the clamping elements can also be designed like shears, the shear ends 27a, 27b of which can be pivoted around the pivot point 26 and partially spread through openings or spreadings into an appropriately shaped circular groove 20c on the lateral surface of the riding ring 10. The clamping strength of the force-fit clamped joint is adjusted on the clamping screw 23.

The top view in Figure 5 shows that the support elements 13, 14 for immobilizing the retaining ring 10 fastened on the rotary-cylinder casing 11 in the axial direction and in the circumferential direction can have spring guides 28, 29 lying axially relative to the rotary cylinder, between each of which is arranged a clamping element 15, 16, etc. tensioned in a force-fit manner on the riding ring 10. These spring guides 28, 29 act like a spring and enable an even more uniform transfer of force from the rotary-cylinder casing 11 to the riding ring 10 via the clamping elements 15, 16, etc. and from there to the baseplate via the track rollers 17, 18.

The exemplary embodiment in Figure 6 differs from the exemplary embodiment in the right half of Figure 4 in that the gripping jaws of the screw jaws of the clamping elements engage around the corner on the riding ring 10; i.e. the gripping jaws 25a engage with circular groove 19a arranged on the interior surface of the riding ring and the gripping jaws 25b engage with a circular groove 20b arranged on the lateral surface on the riding ring.

In accordance with the exemplary embodiment in Figure 7, wedge-shaped elements 30a, 30b, which engage with clamping elements 31 provided with appropriate wedge surfaces, can be inserted into the radial groove 20d in the lateral surface of the riding ring 10, whereby the clamped joint in this solution and thus the entire riding ring fastening are further reinforced as a result of the rotary-cylinder casing 11 set in motion in the direction of the arrow.